

**Department of Energy (DOE)  
FY 2003 Report to Congress**

**Laboratory Directed Research and Development  
(LDRD)**

**at the**

**DOE National Laboratories**



**February 2004**

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### ***Executive Summary***

The Laboratory Directed Research and Development (LDRD) program at the Department of Energy's (DOE's) multi-program National Laboratories, as well as analogous programs at the Department's Plants and at the Nevada Test Site, are Congressionally authorized programs designed to build capability to maintain the vitality of these nationally important institutions. This document fulfills all Congressionally directed LDRD program reporting requirements.

Overall, the multi-program National Laboratories included in this report devoted approximately \$356 million to LDRD, funding projects ranging in size from less than \$30,000 per year to over \$2.5 million, addressing topics that span the entire range of DOE's broad scientific mandate. An analysis of LDRD investments compared to the sources of laboratory funding indicates the LDRD benefits are commensurate with the funding received from defense and non-defense sources.

In response to the fiscal year (FY) 2002 Energy and Water Development Appropriations Conference Report, the Secretary issued guidance requiring all LDRD laboratories to notify other Federal agencies concerning LDRD charges. With the creation of the Department of Homeland Security (DHS), there are additional provisions for the notification of LDRD charges, as well as requirements for acknowledgements regarding the benefits of LDRD, prior to final approval of all DHS projects (see Section 2.4). Collectively these policies provide the basis for the Secretary's affirmation that all FY 2003 LDRD activities derived from funds of other Federal agencies have been conducted in a manner that supports the science and technology development that benefits the programs of the sponsoring agencies and are consistent with the appropriations acts providing funds to those agencies. That required affirmation is included as Appendix 1.

An important component of the LDRD program's contribution to the laboratories' future is its ability to attract promising young scientists and engineers to the institutions. LDRD-funded post-doctoral appointments, for example, supported over 40 percent of all post-doctoral scientists and engineers at the reporting multi-program National Laboratories in FY 2003. In addition, many graduate students participate in LDRD projects, and the LDRD program provides a mechanism for scientists and engineers at the laboratories to keep themselves current in their fields.

The LDRD program is essential to maintaining the vitality of the laboratories that support the Department's missions and national needs. We have carefully reviewed the management and administrative procedures and funding levels at each of the laboratories and will continue to maintain a strong and vital LDRD program at the laboratories.

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### ***1. Introduction***

#### **1.1 Background**

Pursuant to Congressional intent, the DOE multi-program National Laboratories and Manufacturing Plants, and the Nevada Test Site, operate research and development programs using a small portion of their overall budgets for the purpose of investing in critical future needs. This document reports on the programs for FY 2003.

LDRD, the first of these programs, was implemented at the DOE multi-program National Laboratories to formalize what had been a long-standing practice, authorized by legislation, at the multi-program National Laboratories to use portions of laboratory overhead for critical research and development efforts.

Within the overall context of maintaining the vitality of the laboratories, the specific purpose of the LDRD program is to provide the DOE laboratories with funds to undertake creative and innovative research and development activities in order to:

- (1) pursue new and innovative scientific and technological ideas;
- (2) enhance the scientific and technological vitality of the institution;
- (3) manage strategic direction; and
- (4) develop and retain new workforce capabilities.

DOE policy provides clear guidance to ensure effective management and oversight of the LDRD program while supporting the laboratories' abilities to pursue innovative projects. The process is consistent with DOE's management philosophy for all research and development activities, and it includes annual planning and reporting documents as well as program and peer reviews. The National Nuclear Security Administration, the Office of Science, and the Office of Nuclear Energy, Science and Technology serve as cognizant Secretarial officers for the multi-program National Laboratories.

#### **1.2 Purpose of the Report**

Formally, this report responds to the Conference Report (106-988) accompanying the Energy and Water Development Appropriations Act for FY 2001, which directed DOE's Chief Financial Officer "to develop and execute a financial accounting report of LDRD expenditures by laboratory and weapons production plant." It also responds to the Conference Report (107-258) accompanying the Energy and Water Development Appropriations Act for FY 2002 which directs the Secretary of Energy to include in the

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annual report to Congress for all LDRD activities an affirmation that all LDRD activities derived from funds of other agencies have been conducted in a manner that supports science and technology development that benefits the programs of the sponsoring agencies and is consistent with the appropriation acts that provided funds to those agencies. Such an affirmation is included in Appendix 1 of this report.

Further, this report addresses Section 3136(b)(1) of the National Defense Authorization Act for FY 1997 (Public Law 104-201), which requires submission by February 1 of each year “a report on the funds expended during the preceding fiscal year on activities under [the LDRD Program]...to permit an assessment of the extent to which such activities support the national security mission of the Department of Energy.” As defined in its current Strategic Plan, the Department’s national security mission is clearly and comprehensively supported by LDRD activities.

This report addresses how the LDRD program is managed, what research and development activities the funding supports, and why the program is important to DOE and the laboratories. The multi-program National Laboratories organize their respective programs according to their individual needs, however, the LDRD program does have a common administrative approach to Congressional and Departmental guidelines. This report speaks to those commonalities.

This report describes the LDRD program and its implementation at the various DOE multi-program National Laboratories. Newer, analogous programs implemented at the Nevada Test Site and at the manufacturing plants are discussed in detail in Appendices 5 and 6 of this report. They are authorized under separate legislation. The Plant Directed Research, Development and Demonstration (PDRD) program is consistent with Congressional intent as stated in the Energy and Water Development Appropriations Act for FY 2001 (Section 310), and the Defense Authorization Act for FY 2001 (Section 3165) direction to establish a Plant Directed Research, Development, and Demonstration program at the following sites:

- The Kansas City Plant, Kansas City, Missouri;
- The Y-12 Plant, Oak Ridge, Tennessee;
- The Pantex Plant, Amarillo, Texas; and
- The Savannah River Plant, Aiken, South Carolina.

The conference agreement allows for a maximum of 2 percent of the plants’ National Nuclear Security Administration (NNSA) operating budget to be utilized for the PDRD program.

The Site Directed Research, Development and Demonstration (SDRD) program is consistent with Congressional intent as stated in Section 310 of Energy and Water Development Appropriations Act for FY 2002 (H.R. 2311) which authorizes a program for directed research and development at the Nevada Test Site (NTS). The conference agreement allows for a maximum of 2 percent of NTS’s national security budget to be utilized for the SDRD program.

## ***2. FY 2003 LDRD Program***

### **2.1 Laboratory Strategic Themes/Areas**

When planning for the upcoming year's LDRD program, laboratories usually identify several areas of concentration or strategic themes that provide a broad framework for the LDRD program. These areas or themes are used to facilitate enhancing laboratory core competencies that are needed to effectively support current and future DOE and national mission needs. Several of the common themes/areas across the laboratories for the FY 2003 LDRD program included:

- Complex Biological Systems;
- Energy and Environmental Security;
- Environmental Science;
- Improved Remediation and Waste Disposal Technologies;
- International and Homeland Security Technologies;
- Nanotechnology;
- Nuclear Weapons Science and Technology;
- Nonproliferation, Counterproliferation and Arms Control; and
- Petaflops and Computational Science.

It is important to note that not all LDRD projects can or should be classified under such areas because it is the nature of LDRD to respond to the best employee suggested ideas even when they do not fall under a predetermined theme or area. The emphasis of each laboratory on any given topic, and the details of the science and technology a given laboratory considers most germane, will vary according to the needs of the laboratory and the concepts developed and proposed by the laboratory staff. In addition, each laboratory will consider its strategic needs for hiring and retention, and develop a portfolio of LDRD projects designed to ensure that the crucial long term skills and capabilities are enhanced through LDRD investments.

### **2.2 Financial Information**

#### ***2.2.1 LDRD Funding Mechanism***

The LDRD program is structured to pursue innovative and creative science and technology, often with an emphasis on projects that will contribute to the needs of multiple programs and Federal agencies. The Department views LDRD as a legitimate cost of doing business for all sponsors at the multi-program laboratories. Therefore, to ensure that all users of the laboratories support their fair share of LDRD, the costs are funded as part of laboratory indirect costs, up to a maximum of 6 percent of operating and capital equipment costs, and are treated as normal costs of doing business. As such, all organizations that fund laboratory programs also fund LDRD activities. The capabilities developed and maintained through LDRD, in turn, benefit all laboratory customers. This combination of equitable treatment of laboratory sponsors and multiple benefits derived from LDRD is achievable only through the

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indirect cost funding mechanism for LDRD. The combination also underscores the value of the LDRD program to the laboratories and to the Nation.

The pricing policy of DOE is full cost, which includes all direct costs incurred in performing the work, allocable cost incurred by DOE and its contractors at any Departmental facility in performing work on behalf of non-DOE entities, and a Federal administrative charge of 3 percent of these costs. LDRD charges and assessments on Work for Others (WFO) agreements are discussed in more detail in Section 2.4. LDRD is considered an allocable cost in accordance with the terms of the laboratory operating contract and is identified in the laboratory's accounting system. Laboratory indirect costs are applied to all funds that come to the laboratories at rates reviewed by the Department. Exemptions from that assessment are uncommon, require the approval of Federal personnel and are reviewed annually. As a general policy, capital construction costs and major "pass-through" costs are exempted from a full indirect cost assessment, including LDRD.

### *2.2.2 FY 2003 Expenditures*

For FY 2003 the multi-program National Laboratories devoted approximately \$356 million to LDRD. The following table shows the LDRD costs by site for FY 2003. For more details on the individual projects conducted at each site, see Note 1. Note 1 provides a project listing by site including project identifier, project name and total FY 2003 project costs. It should be noted that the following table includes all LDRD costs including individual project costs listed in Note 1 and any administrative costs not specifically assigned to individual FY 2003 projects, if applicable.

**Table I. FY 2003 LDRD Costs by Laboratory**

<b>Laboratory</b>	<b>LDRD Project Costs (\$M)</b>
ANL	22.4
BNL	7.8
INEEL	20.2
LANL	96.1
LBNL	10.7
LLNL	65.7
ORNL	16.1
PNNL	17.3
SNL	100.0

### *2.2.3 FY 2003 LDRD Allocation Percentages*

Departmental policy states that the maximum funding level established for LDRD must not exceed 6 percent of the laboratory's total operating budget, including non-DOE funded work for the year, plus an amount of capital equipment not to exceed 6 percent of its total capital

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equipment budget for the year. It is important to note that individual LDRD program estimates at each site are approved based on laboratory estimated budgets for the fiscal year. Initial planning bases are derived from funds anticipated. The final percentage calculation is based upon actual LDRD costs and actual operating and capital equipment costs. Table II below includes the FY 2003 end-of-year information. It is important to note that “laboratory costs” are not the amount of laboratory program funding, but rather what was accumulated as costs. Also shown is the cost of work performed on behalf of other Federal agencies and non-Federal customers’ WFO programs. LDRD charges and assessments on WFO agreements are discussed in more detail in Section 2.4.

**Table II. Reported FY 2003 overall laboratory costs and LDRD costs at participating DOE laboratories.**

<b>Laboratory</b>	<b>Laboratory WFO Costs (\$M)</b>	<b>Total Laboratory Costs (\$M)</b>	<b>LDRD Costs (\$M)</b>	<b>LDRD Fraction</b>
ANL	95.3	517.4	22.4	4.33%
BNL	85.5	428.7	7.8	1.82%
INEEL	102.6	722.7	20.2	2.79%
LANL	248.6	1794.5	96.1	5.36%
LBNL	100.1	441.5	10.7	2.42%
LLNL	283.5	1272.2	65.7	5.16%
ORNL	172.6	690.5	16.1	2.33%
PNNL	94.5	452.7	17.3	3.82%
SNL	451.3	1742.9	100.0	5.74%

In addition, an analysis of the FY 2003 LDRD program was conducted as it relates to funding received from both defense and non-defense sources (including DOE and WFO sponsors) and the return on the dollars invested by those sources in the LDRD program.

The total FY 2003 funding for the LDRD program conducted at the laboratories was approximately \$356 million, which represents about 4 percent of the total laboratory costs at these laboratories. Of this amount, \$243 million was provided by defense customers and \$113 million by non-defense customers. A review of the LDRD program funding shows that about \$268 million supports projects that will be expected to benefit the defense and national security missions, and \$283 million supports projects that will be expected to benefit non-defense customer mission areas.

In assessing the return on the dollars invested in LDRD, it is essential to understand that the vast majority of research and development activities have application to national needs in both defense and non-defense arenas. That is, as the numbers above indicate, many of the LDRD projects are put in both categories since they support fundamental research and can be



expected to benefit both defense and non-defense missions. The clear implication is that the anticipated benefit of LDRD science and technology to defense and non-defense national needs will always exceed the relative contribution of funds from either source independently. This leveraging of the research capabilities of the DOE's multi-program laboratories is one of the great benefits of the LDRD program and its focus on the long-term vitality of the laboratories.

### **2.3 Workforce Development**

Maintaining the vitality of the DOE multi-program National Laboratories—the overarching theme of the LDRD program—implies a responsibility not only for future-looking research and development but also for the workforce of the future. For the laboratories to be poised to tackle problems confronting DOE and the Nation it requires more than facilities and infrastructure. Scientists and engineers must also be available to implement the capabilities of the laboratories.

Post-doctoral appointments offer the single largest source of new scientific and engineering talent for the DOE laboratories and are therefore critical to maintaining institutional vitality. The LDRD program plays a central role in the various post-doctoral programs at all of the laboratories, as shown in Table III.

**Table III. Postdocs supported by LDRD at the DOE Laboratories in FY 2003.**

<b>Laboratory</b>	<b>Total postdocs</b>	<b>Postdocs supported by LDRD</b>	<b>LDRD-supported fraction</b>
ANL	203	50	25%
BNL	162	44	27%
INEEL	18	14	78%
LANL	499	278	56%
LBNL	235	60	25%
LLNL	143	100	70%
ORNL	231	64	28%
PNNL	206	64	31%
SNL	169	82	49%

In addition to this formal participation in post-doctoral programs, the LDRD program also supports a wide range of activities that enhance the laboratories workforce development. These include support for both undergraduate and graduate students working on LDRD projects, reputation building by providing laboratory visibility in a wider range of publication venues than would be the case without the results of LDRD, technical staff retention associated with opportunities to retain and hone scientific skills via LDRD, and a remarkable range of university collaborations stimulated via LDRD projects.

## **2.4 LDRD and the Work for Others Program**

One of the major benefits the Nation derives from the DOE multi-program National Laboratories is the synergistic application of science and technology to a broad range of critical national security and science missions, through the DOE WFO program.

As mentioned above, the LDRD program is structured to pursue innovative and creative science and technology, often with an emphasis on projects that will contribute to the needs of multiple programs and Federal agencies. All WFO sponsors benefit from the strong science and technology base enhanced by LDRD. The Department views LDRD as a legitimate cost of doing business for all programs at the multi-program laboratories. Therefore, to ensure that all users of the laboratories support their fair share of LDRD innovations, the cost is included as an allocable cost. The pricing policy of DOE is full cost, which includes all direct costs incurred in performing the work, allocable cost incurred by DOE and its contractors at any Departmental facility in performing work on behalf of non-DOE entities, and a Federal administrative charge of 3 percent of these costs. LDRD is considered an allocable cost in accordance with the terms of the laboratory operating contract and is identified in the laboratory's accounting system.

These WFO programs are possible because the laboratories have developed unique research and development capabilities in a wide range of areas of relevance to organizations besides DOE. WFO customers seek out these capabilities and, in many cases, initiate WFO research and development at the laboratories. WFO research broadens the base of innovation at the DOE laboratories and increases the number of potential solutions to national challenges, including threats to national security. The laboratories' research results are enhanced by the cross-pollination of technologies developed in conjunction with its WFO partners.

In this regard, Congress provided language in the Conference Report accompanying the FY 2002 Energy and Water Development Appropriations Act that requires the Department to notify other Federal agencies that a portion of the funds collected through the WFO program will be used to fund LDRD projects. In addition, with the creation of the DHS, Congress enacted analogous requirements that LDRD funding associated with DHS programs be used to support DHS missions. As noted earlier, the Conference Report also requires the Secretary to affirm that all LDRD activities derived from funds of other agencies have been conducted in a manner that supports science and technology development that benefits the programs of the sponsoring agencies and is consistent with the appropriation acts that provided funds to those agencies.

In response to the FY 2002 Conference Report, the Secretary issued guidance requiring all LDRD laboratories to notify other Federal agencies concerning LDRD charges. These procedures changed the WFO process to ensure proper notification of other Federal agencies as to the LDRD charges prior to funding work at the laboratory. Specifically, each new and/or revised WFO proposal provided to a Federal agency must indicate the amount of LDRD charges that will be collected. Furthermore, the proposal notifies the sponsor that, by

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providing funding, the agency is acknowledging that LDRD activities are beneficial to their organization and consistent with appropriation acts providing funds to that agency. Subsequently, each WFO funding acceptance document also includes the LDRD estimate acknowledgement.

In February 2003, the Secretary of Energy and the Secretary of Homeland Security entered into a Memorandum of Agreement to implement key provisions of the Homeland Security Act. In addition, the Deputy Secretary of Energy issued a DOE Notice on *Reimbursable Work for the Department of Homeland Security*. The purpose of that document was to provide information on the process by which the DHS may place orders for reimbursable work activities to be performed at the DOE laboratories. Within that Notice, there are provisions for the notification of LDRD charges in the cost proposal as well as requirements for acknowledgements regarding the benefits of LDRD prior to final approval.

These policies have been implemented and provide a basis for the Secretary to affirm that the LDRD program is managed in accordance with the Congressional direction cited above. The Secretarial affirmation is included as Appendix 1. More recently, the DOE Acting Chief Financial Officer transmitted applicable guidance and policy to reiterate the process to other Federal agency Chief Financial Officers who are customers and sponsors of work at the Department's laboratories.

### ***3. Report Conclusions***

The DOE LDRD program offers a crucial mechanism by which the multi-program National Laboratories maintain their vitality and, in the process, prepare themselves to meet the Nation's future scientific and engineering challenges. In FY 2003, the multi-program National Laboratories devoted approximately \$356 million to LDRD, funding projects ranging in size from less than \$30,000 per year to over \$2.5 million. LDRD projects address topics that span the entire range of DOE's broad scientific mandate. An analysis of LDRD investments compared to the sources of laboratory funding indicates the LDRD benefits are commensurate with the funding received from defense and non-defense sources. In addition, the Department affirms that all FY 2003 LDRD activities derived from funds of other Federal agencies have been conducted in a manner that support the science and technology development that benefit the programs of the sponsoring agencies and are consistent with the appropriations acts providing funds to those agencies.

An important component of the contribution of the program to the laboratories' future is their ability to attract promising young scientists and engineers to the institutions. LDRD funded post-doctoral appointments, for example, supported over 40 percent of all post-doctoral scientists and engineers at the multi-program National Laboratories in FY 2003. In addition, many graduate students participate in LDRD projects, and the programs provide a mechanism for scientists and engineers at the laboratories to keep themselves current in their fields.

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The LDRD program is essential to maintaining the vitality of the laboratories that support the Department's missions and national needs. We have carefully reviewed the management and administrative procedures and funding levels at each of the laboratories and will continue to maintain a strong and vital LDRD program at the laboratories.

### **LDRD Legal Authority and Order**

The LDRD program operates under the same statutory and Departmental guidance that it has in past years, and the laboratories work closely with DOE personnel to assure the careful Federal oversight that both the letter and spirit of the guidance intends.

#### **Authorization Basis**

The Atomic Energy Act (AEA) of 1954, as amended, 42 U.S.C. 2011 et seq., Section 31, directs DOE to exercise its powers to ensure the continued conduct of R&D and training activities and to assist in the acquisition of an ever-expanding body of theoretical and practical knowledge in the fields of energy, its production, uses, handling, and effects. This mission was initially the responsibility of the Atomic Energy Commission (AEC), then the Energy Research and Development Administration, (ERDA) and subsequently that of DOE.

The current LDRD program is consistent with the mission of providing a program of conducting, assisting, and fostering research and development to encourage maximum scientific and industrial progress, contemplated in Section 3 of the AEA and confirmed in subsequent laws applicable to the successor agencies, ERDA and DOE. Public Law 95-39 (Section 303), dated June 3, 1977, authorized any laboratory under contract with ERDA, with the Administrator's approval, to "use a reasonable amount of its operating budget for the funding of employee-suggested research projects."

Section 3132(d) of the National Defense Authorization Act for FY 1991 (Public Law 101-510), set the funding limit for each Laboratory's program at 6 percent of the Laboratory's total operating and capital equipment budget. In FY 2000, Section 308 of the Energy and Water Development Appropriations Act (H.R. 2605) reduced the funding level to 4 percent with the additional restriction that none of the funds in the Environmental Management programs are available for Laboratory Directed Research and Development. This reduction had a notably deleterious effect on the LDRD program and the DOE National Nuclear Security Administration (NNSA) Laboratories. The Energy and Water Development Appropriations Act for FY 2001 (Section 306) restored the funding to 6 percent, and the explanatory language of the accompanying Conference Report (106-988) directed the Department's Chief Financial Officer "to develop and execute a financial accounting report of LDRD expenditures by laboratory and weapons production plant." The 6 percent funding level remained in effect in FY 2003.

## **DOE Orders Governing the LDRD Program**

With this authorization basis, the LDRD program, since its inception in FY 1991, has been under continual oversight by DOE to ensure compliance with Congressional requirements. During 1991, the Department developed and implemented DOE Order 5000.4, *Laboratory Directed Research and Development*, establishing formal processes to manage and oversee the LDRD program. These processes have been subject to ongoing Departmental review and revision to ensure compliance with Congressional intent and with Departmental policies and requirements. On April 9, 1992, the DOE Order was revised to increase the emphasis on Departmental oversight of research and development activities. In 1993, individual program organizations provided additional instructions through a set of “Responsibilities and Guidelines.” In 1997, DOE updated the 1992 DOE LDRD Order to DOE Order 413.2, *Laboratory Directed Research and Development*,<sup>1</sup> and more recently to DOE Order 413.2A, *Laboratory Directed Research and Development*,<sup>2</sup> to include the new NNSA.

The DOE Order 413.2A provides guidance in the following areas:

- General criteria for the selection of LDRD projects;
- Limitations on the duration of LDRD projects;
- Limitations on the total maximum annual funding for the LDRD program;
- Excluded activities under LDRD funding;
- Responsibilities of DOE offices (including field offices); and
- Contractor requirements, including annual planning and reporting documents.

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<sup>1</sup> DOE Order 413.2, March 5, 1997.

<sup>2</sup> DOE Order 413.2A, op. cit., p. 1.

## DOE Program Management and Oversight

### Overview

DOE's oversight of LDRD activities ensures that the objectives stated in DOE Order 413.2A, *Laboratory Directed Research and Development*, are accomplished by each laboratory's LDRD program. The objectives are to "maintain scientific and technical vitality of the laboratories; enhance the laboratories' ability to address future DOE missions; foster creativity and stimulate exploration of forefront science and technology; serve as a proving ground for new research; and support high-risk, potentially high-value research and development."

The oversight process is consistent with DOE's overall management approach and philosophy for all research and development activities, and includes annual planning and reporting documents and program and peer reviews. The Department followed a rigorous process in developing the LDRD policy and establishing the 6 percent maximum level. The 6 percent limit is a maximum and not an automatic provision. The Department approves a specific level of funding and a plan for each laboratory annually. In addition to the requirements and specific oversight mechanisms defined in DOE Order 413.2A, the Department conducts an annual evaluation of the full spectrum of science and technology at the laboratories as part of the overall appraisal of contractor performance. This evaluation spans all programmatic activities, and specifically includes LDRD, looking at its quality of science, strategic alignment, and relevance to DOE missions.

Much of the input to this retrospective evaluation comes from independent external peer review committees composed of scientific leaders from industry and academia as well as from the Federal research community including the laboratories themselves. The result of this science and technology evaluation is additional input for the Department in the assessment of the value and level of funding for LDRD activities. In addition, LDRD is an integral element of the laboratories strategic planning process and all research and development, including LDRD, conducted at the laboratories is reviewed at least annually through on-site reviews.

The Office of Science (SC), the Office of Nuclear Energy, Science and Technology (NE), and the NNSA have established a common oversight process to ensure the laboratories effectively manage their LDRD programs in accordance with DOE Order 413.2A. The process is designed to allow flexibility to the laboratory in implementing its LDRD program, while ensuring effective DOE oversight and stewardship of the taxpayers' dollars.

## **Planning**

Each laboratory is required to submit an annual LDRD Program Plan for approval to the cognizant Secretarial Officer and Site Office Manager before the start of the fiscal year. The plan must include a requested funding level as well as a general description and justification of the LDRD program. It must describe how the LDRD program will contribute to and strengthen the laboratory's science and technology capabilities, support the laboratory's mission and benefit the Department and the Nation. In addition, each laboratory must establish and describe criteria for selecting and prioritizing projects. These criteria include utilizing internal peer and scientific management reviews that support and validate the innovative scientific and technological excellence of the program. The cognizant Site Office reviews the laboratory's proposed annual LDRD plan and funding level and provides its written recommendation to the cognizant Secretarial Officer.

As part of this recommendation, the Site Office Manager certifies that the laboratory's method for accumulating LDRD funds meets the requirements of DOE Order 413.2A. The Order requires Site Office Managers to annually review and certify to Headquarters that the laboratory's method for accumulating LDRD funds is consistent with the maximum allowable funding, and is in accordance with terms and conditions of the laboratory's contract. The Site Office LDRD managers, as well as the field financial managers, are involved in conducting these reviews in early summer of each year. Financial accountability, as demonstrated by these reviews, is a strong factor in the Site Office's recommendation to the Department of the LDRD funding level.

The cognizant Secretarial Officers annually approve each laboratory's LDRD plan and the maximum funding that may be expended on LDRD activities for the next fiscal year. This approval is based on the reasonableness of the documentation, the Site Office's recommendation, results from the prior year's review of the program, and the Laboratory's overall performance in managing its LDRD program. The approval also considers input from appropriate Departmental program managers. Throughout the fiscal year, the DOE works closely with each laboratory and reviews any proposed LDRD program modifications or adjustments to ensure that the laboratories realize optimum mission benefits. No individual LDRD project may begin without concurrence from DOE.

## **Implementation**

DOE has established efficient management policies and processes to provide effective oversight of the LDRD program. The management processes ensure proper oversight of current research thrusts while maintaining flexibility to address future needs.



The laboratories implement the LDRD program in accordance with the requirements in DOE Order 413.2A. While the timing or details of discrete DOE oversight activities may differ somewhat from laboratory to laboratory, the oversight processes among all the DOE program offices have certain key elements in common. For example, all LDRD projects are reviewed and approved by the cognizant Federal official prior to any work starting. In addition, DOE conducts a review of each laboratory's LDRD program to ensure consistency with Department policy, and to review technical success and proposed research. In the case of the three NNSA Laboratories, the review is conducted late in the fiscal year (August/September), permitting review and concurrence of proposed research for the next fiscal year. NE and SC conduct their LDRD program reviews earlier in the year (May/June), prior to completion of the research proposal review cycle, and consequently have a separate activity later in the year that involves DOE concurrence of the next year's research portfolio. Representatives from other laboratories, as well as appropriate Departmental program managers, are invited to participate in the LDRD program reviews, to share lessons learned, and to promote best practices and continuous management improvement across the laboratories. All the laboratories have processes to review and assess the performance of individual research projects, and DOE is involved in those processes at the field offices as well as Headquarters. Again, the timing and details of this activity may vary among the program offices, but the end result is the same: corrective actions resulting from the oversight are implemented as needed, including changes in project scope, emphasis, or funding.

In addition to the specific oversight mechanisms defined in DOE 413.2A, the Department and its contractors conduct an annual evaluation of the full spectrum of science and technology at the laboratories as part of the overall evaluation of contractor performance. This evaluation spans all programmatic activities, and specifically includes LDRD, looking at its quality of science, strategic alignment, and relevance to DOE missions. Much of the input to this evaluation comes from independent external peer review committees composed of scientific leaders from industry and academia. The results of this science and technology evaluation are additional input for Headquarters in assessing the value and determining the funding level for LDRD activities.

## **Reporting**

At the end of the fiscal year, each laboratory is required to submit an annual LDRD report to the cognizant Secretarial Officer and Site Office Manager. The LDRD Annual Report includes a technical and financial overview of the program as well as a short summary of each funded project. The Annual Report, in conjunction with the LDRD Program Plan, contains a description of the laboratory's LDRD management process, a summary of how the laboratory's LDRD portfolio relates to DOE/Laboratory missions, initiatives, and strategic plans, a description of the peer review process under which the LDRD projects are evaluated along with any relevant results; and a summary of the

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metric data as success indicators. Aggregated performance indicators, such as patents, awards, and follow-on funding, collected on the LDRD portfolio at each Laboratory are useful in revealing trends on the overall productivity of the program over time, although some of the more measurable results occur years after project completion.

The Site Office reviews the laboratory's LDRD Annual Report and forwards it to the Cognizant Secretarial Officer certifying the adequacy of the laboratory's LDRD management process and Laboratory adherence to the established criteria for LDRD projects. The Cognizant Secretarial Officer also reviews each laboratory's Annual Report to assess the laboratory's LDRD management systems and program performance. As part of this review, SC, NNSA, and NE ensure that the appropriate Headquarters program managers are involved as questions related to their programs are discussed and resolved.

In its independent FY 2001 report to Congress, the General Accounting Office stated,<sup>3</sup>

“All the LDRD projects we reviewed at the ...laboratories we visited met DOE's guidelines for selection [and] had created the internal controls necessary to reasonably ensure compliance with DOE's guidelines. The key controls in place included using DOE's guidelines to control and conduct the project-selection process ...and ensuring appropriate DOE oversight and review of the results of the process.”

In summary, DOE's oversight includes project approval, financial certification reviews, appraisal process reviews, Program Plan reviews (both in the field and at headquarters) and onsite reviews (both of technical content as well as management processes). Annually, DOE issues an approval letter for each laboratory's LDRD Program Plan and confirms the maximum LDRD funding level that may be used for the program. Throughout the fiscal year, DOE works closely with each laboratory and reviews any proposed additions or adjustments to the program to ensure compliance with the DOE Order and that optimum mission benefit is realized by both DOE and the laboratories.

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<sup>3</sup> GAO-01-927, *op. cit.*, p. 10.

## **Laboratory Program Management**

### **Overview**

The DOE laboratories have implemented similar processes to manage their LDRD programs and select projects for funding. These processes have three major components: (1) a top-level strategic planning process to identify strategic science and technology areas for LDRD investment; (2) a call to the laboratory scientific and technical community for innovative and relevant proposals within the DOE mission areas; and (3) a scientific peer-review process to select an LDRD portfolio from these proposals, and a ranking process by senior management to prioritize the portfolio of projects for funding.

### **Strategic Planning**

Early each fiscal year, laboratory directors and their senior management begin the LDRD cycle for the following year with a review of strategic directions, an assessment of the health of the science and technology underpinning laboratory missions, and an evaluation of the need for far-reaching fundamental research and development to maintain laboratory vitality for future missions. These activities identify the laboratory's strategic research and development needs. The review provides target allocations and determination of the LDRD program funding level as a percentage of the laboratory's total operating and capital equipment budget.

Within the LDRD program, priorities and budgets are set for three types of projects: (1) research and development demonstrations or proof-of-concept; (2) multifaceted research and development that has the potential to alter the laboratories' approach to solving programmatic challenges; and (3) long-range, high-risk fundamental research and development in broad science and technology areas underlying the laboratories' competencies and mission areas.

This process demonstrates the importance that laboratory senior management places on LDRD as a tool to maintain the vitality of the laboratories and to meet future programmatic needs and missions.

### **Call for LDRD Proposals**

Once the strategic direction for the LDRD program is established, the laboratory LDRD program office issues calls for proposals to the scientific and technical community. This open call for proposals encourages the broadest participation from all laboratory scientific and technical staff, and ensures that the most innovative approaches are brought forward. Proposed projects range from those that focus strictly on strategic science and

technology development to those highly innovative, creative projects that enhance the capabilities of the laboratories to accomplish their missions.

### **Selection of Projects for Funding**

All proposals are subject to two types of review: scientific peer review and management review. The scientific peer review is based on criteria that include an evaluation of the proposal's innovation, impact, risk, programmatic and strategic relevance, scientific quality, feasibility, and quality of the project team. In a recent report reviewing the LDRD Program, the General Accounting Office described the peer-review process as follows:

“All laboratories used DOE’s LDRD Order 413.2A as the primary guidance to review and select projects. Individuals involved in the review and selection of the projects had the requisite background and experience to provide credible review. Those individuals had wide-ranging scientific backgrounds—usually a Ph.D. in scientific research and practical experience in basic scientific research. When the subject matter of a project proposal was outside the knowledge base of the review team, the laboratories generally contracted with outside experts to provide reviews and recommendations on the merits of that proposal. In general, each laboratory established review panels comprising individuals from across the laboratory, which provided for diverse opinions to ensure that various points of view were brought to bear on the selection decision.”

The management review includes participation by laboratory senior managers, program leaders, and leading scientists in selecting a portfolio of projects of the highest quality that are aligned with the strategic requirements of both DOE and the laboratories. Analysis of LDRD program data from the last few years indicates that the total estimated dollar value of those proposals that meet or exceed the selection criteria far exceeds the funding available at a 6 percent funding level. Each laboratory Director is responsible for final portfolio balance and project funding decisions.

In addition, the laboratories conduct reviews to assess technical progress and track project costs. In the post-performance stage, separate and independent external peer review advisory committees consisting of subject matter experts from academia and industry conduct peer reviews of LDRD projects as an integral part of the Department’s scientific program reviews. These scientific peer reviews are conducted for all technical divisions on a rotating basis as part of the contract mechanism and annual performance evaluation.

The various peer review and self-assessment processes described above are designed to ensure that the laboratories’ LDRD programs comply with DOE requirements, represent innovative and creative science, strengthen technical capabilities, and contribute to each institution’s pursuit of excellence in science and technology. The peer review process

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has evolved over several years of continuous improvement and is consistent with principles employed by other peer review processes performed by other agencies, such as the National Science Foundation and National Institutes of Health. The laboratories and DOE will continue to look for ways to improve these processes to enhance and strengthen the LDRD program.

## **Plant Directed Research, Development and Demonstration Program**

### **Program Overview and Philosophy**

The National Nuclear Security Administration (NNSA) Defense Programs (DP) Plant Directed Research, Development and Demonstration (PDRD) Program supports science-based manufacturing related to the NNSA weapons mission. Projects emphasize applied science and technology that enhance the manager's technology development capabilities and core competencies. Technical staff at the plants have the opportunity to explore innovative scientific and technological opportunities that hold high potential for payoff in mission applications.

The PDRD Program described in this document is consistent with Congressional intent as stated in the Energy and Water Development Appropriations Act for FY 2001 (Section 310) and the Defense Authorization Act for FY 2001 (Section 3165) which authorized the establishment of a Plant Managers Research, Development, and Demonstration Program at the following sites:

- The Kansas City Plant (KCP), Kansas City, Missouri,
- The Y-12 Plant (Y-12), Oak Ridge, Tennessee,
- The Pantex Plant, Amarillo, Texas, and
- The Savannah River Plant (SRP), Aiken, South Carolina.

The conference agreement allows for a maximum of two percent of the plants' NNSA operating budget to be utilized for the PDRD Program. The Authorization Act and Conference Report language instruct NNSA to establish and conduct an LDRD-type program for the nuclear weapons plants. The LDRD enabling legislation serves as a guide for the PDRD Program. The authorization basis for LDRD as defined by Section 3132(d) of the National Defense Authorization Act for FY 1991 and the policy and guidance contained in DOE Order 413.2A will be followed to the extent practicable.

By extension of the LDRD authorization basis, PDRD funds are to be used for research, development, and demonstration projects that are of a creative and innovative and potentially high value to the NNSA facility conducting the effort. The projects are selected by the Contractor Manager of a site for the purpose of maintaining or improving the vitality of the enterprise in mission-related scientific disciplines. The PDRD Programs provide the NNSA nuclear weapons plant managers the flexibility to invest in longer-term, higher-risk, and potentially higher-payoff research activities that enhance the science and technology capabilities of the plants.

In structuring the PDRD Program to enhance and maintain the “vitality” of the nuclear weapons plants, specific attention will be placed on the following areas:

- Retention and recruitment of individuals with knowledge, experience, and skills that are critical to the success of site operations today and in the future;
- Exploration of enhanced core competencies and achievement of new or improved capabilities required for current and future technical missions; and
- Replenishment of the pipeline of proven concepts that can improve or replace current practices, products and processes with developing and demonstrating innovative agile process technologies.

Individual programs at each site will be structured to incorporate Defense Program goals and will be consistent with the NNSA Strategic Plan and that site’s corresponding goals and objectives for the future.

### **Program Description - Roles & Responsibilities**

The PDRD Program is analogous to the LDRD Program with appropriate differences to assure the program is focused on relevant manufacturing test technologies. It should be noted that the PDRD Program provides the site managers with broad flexibility for program implementation while NNSA’s role is one of oversight and concurrence. Acting as the Cognizant Secretarial Officer designee, the Assistant Deputy Administrator for Military Applications and Stockpile Operations, through the applicable Program Manager, has primary responsibility for the PDRD Program. The NNSA Federal Site Office is responsible to assure that site program plans and accounting practices are consistent with the intent of the implementing legislation, that the projects selected are representative of the NNSA and site's strategic goals and mission, and that promising projects are highlighted to other NNSA programs for further development.

### **Program Components**

The PDRD Program at the sites will consist of four main components:

1. A top level program planning process that results in identification of strategic manufacturing science and technology areas for targeted investment;
2. A call to plant scientific, engineering, manufacturing, and /or program management personnel for innovative and relevant proposals in the target investment areas;
3. A review process to select from the proposals a project portfolio for funding; and
4. A process for measuring and evaluating the program's effectiveness.

## **Fiscal Guidance**

The maximum funding level established must not exceed 2 percent of the NNSA operating budget for the year as determined by Congress. The system of accrual of these funds shall, to the extent reasonable, provide for equitable pro rata contributions by all sources of NNSA funding. Construction line item projects are excluded. Expenditures shall be considered an allowable cost in accordance with the terms and conditions of the operating contract and shall be identifiable and traceable within the accounting system for ease of annual certification.

PDRD funds may not be used to substitute for or supplement funding for any tasks or project required, planned, and budgeted by the NNSA or any other agency to meet current mission needs. PDRD funds may be used to fund conceptual or preliminary designs, but may not be used to fund any construction design (e.g. Title I). PDRD funds may be used to fund capital expenditures for acquisition of general-purpose equipment as long as the equipment is required to complete the project and would not otherwise be readily available from the plant inventory. PDRD funds may not be used to supplement a site's general capital equipment budget. Occasionally a small proportion of funds may be used to survey and evaluate the suitability of competing commercially available technical solutions in order to develop an optimum procurement recommendation.

The FY 2001 Energy and Water Development Appropriations Subcommittee Conference Report directed the Chief Financial Officer (CFO) to develop and execute a financial report of expenditures by site. The CFOs of the sites are responsible for preparing this report and it will include written assurance that the method for accumulating funds is consistent with DOE Order 413.2A. In addition, CFOs shall assure that cost information reported by their site is in agreement with the site financial records.

## **Defense Programs' Oversight of the Program**

The purpose of program oversight is to ensure that each site carries out the objectives stated in the law enabling the Program. Site Offices review the plant program and processes to ensure that they adhere to NNSA policy and guidance, are consistent with DP mission needs, and recommend approval of the program plan for the upcoming year to the Program Manager.

As part of the appraisal of overall contractor performance, the Site Office will conduct an annual evaluation of the full spectrum of activities at the site. This evaluation spans all programmatic activities, and specifically includes an evaluation of the quality of the technical work, strategic alignment, and relevance to the NNSA missions. This annual evaluation relies heavily on the site's self-assessment process. The Site Office may also conduct interviews or request written evaluations from cognizant NNSA managers for all



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programs at the site. The evaluation provides additional input for senior NNSA program officials to use in assessing the value being realized from the level of funding being applied. Technical program reviews to ensure that the PDRD Program and individual projects are in support of the NNSA mission are also conducted.

The Plants participating in the program will provide, to their Site Office, a proposed program plan for the upcoming fiscal year. Both the Site Office and the Program Manager will review and analyze the plan, taking into account NNSA policy, alignment with guidance, mission relevance, strategic planning, operational needs, and general program performance. Additionally, each site's proposed plan and requested program funding level is evaluated against Congressional requirements regarding support of NNSA's national security mission. The Program Manager assembles the annual PDRD program plan which includes the individual site plans, and submits it to the cognizant Secretarial Officer or designee along with a recommendation on the plan and the program funding level. At the start of the fiscal year, the cognizant Secretarial Officer or designee assesses the plan and the Program Manager's recommendation and makes the final decision to approve the program plan.

Plants participating in the program will propose projects for review by the Site Office and the Program Manager. Site Office concurrence is required prior to initiating work on a project although the Site Office will request and address any concerns of the Program Manager before concurrence is given. Throughout the fiscal year, the Site Office works closely with their site reviewing any proposed modifications or adjustments to the program for adherence to NNSA guidelines and the site's program plan, and notifying the Program Manager of any potential issues.

#### **Fiscal Year 2003 PDRD Program Expenditures**

The following table shows FY 2003 PDRD program expenditures by site. It should be noted that the table includes all PDRD costs including individual project costs listed in Note 1 and any administrative costs not specifically assigned to individual FY 2003 projects, if applicable.

<b>Plant</b>	<b>NNSA/DP Funding (\$M)</b>	<b>PDRD Costs (\$M)</b>	<b>PDRD Fraction</b>
KCP	335	\$5.4	1.61%
Pantex	\$423.9	\$5.1	1.20%
SRP	\$147	\$2.5	1.70%
Y-12	\$554.9	\$6.4	1.15%

## Site Directed Research, Development and Demonstration Program

### Program Overview and Philosophy

The National Nuclear Security Administration (NNSA) Defense Programs (DP) Nevada Test Site Directed Research, Development and Demonstration (SDRD) program supports technology development related to the NNSA weapons mission. The program is administered by the Management and Operations contractor for the Nevada Test Site (NTS). Technical staff at NTS operational sites have the opportunity to explore innovative scientific and technological opportunities that hold high potential for payoff in mission applications.

Section 310 of H.R. 2311, the Energy and Water Development Appropriations Act for FY 2002 states *“The Administrator of the National Nuclear Security Administration may authorize the manager of the Nevada Operations Office to engage in research, development, and demonstration activities with respect to the development, test, and evaluation capabilities necessary for operations and readiness of the Nevada Test Site: Provided, That of the amount allocated to the Nevada Operations Office each fiscal year from amounts available to the Department of Energy for such fiscal year for national security programs at the Nevada Test Site, not more than an amount equal to 2 percent of such amount may be used for these activities.”*

Furthermore, the Act and accompanying Conference Report authorizes NNSA to establish and conduct an LDRD-type program for the nuclear weapons plants. The LDRD enabling legislation serves as a guide for the SDRD program. The authorization basis for LDRD is defined by Section 3132(d) of the National Defense Authorization Act for FY 1991, and the policy and guidance contained in DOE Order 413.2A will be followed to the extent practicable.

By extension of the LDRD authorization basis, SDRD represents research, development and demonstration work of a creative and innovative nature selected by a senior management committee for the purpose of maintaining the vitality of the Site in mission-related scientific disciplines. SDRD provides the NNSA nuclear weapons plant and test site managers the flexibility to invest in longer-term, higher-risk, and potentially higher-payoff research activities that enhance the science and technology capabilities.

In structuring the SDRD program to enhance and maintain the “vitality” of the NTS and the technical base for carrying out the NTS DP mission, specific attention will be placed on the following areas:

- Retention and recruitment of individuals with critical skills;

- Maintenance of core competencies required for current and future technical missions; and
- Developing and demonstrating innovative, agile technology to replace outdated technology.

The program will be structured to incorporate Defense Programs' goals and will be consistent with the NNSA Strategic Plan.

### **Program Description - Roles & Responsibilities**

The SDRD program is analogous to the LDRD program with appropriate differences to assure the program is focused on instrumentation and diagnostic technologies critical to the performance of the NTS stockpile stewardship and nuclear security response missions. The main elements and responsibility matrix for the SDRD program is given below. It should be noted that the SDRD program, like the LDRD program, provides NTS with broad flexibility for program implementation and NNSA's role is one of limited oversight and concurrence. Acting as the Cognizant Secretarial Officer designee, the Assistant Deputy Administrator for Research, Development and Simulation, through the DP Program Manager, has primary responsibility for the SDRD program. The Federal Site Office at NNSA/Nevada is responsible for implementation and oversight.

### **Program Components**

The SDRD program will consist of three main components:

1. A top level program planning process that results in identification of strategic science and technology areas for targeted SDRD investment;
2. A call to scientific, engineering, and /or other technical personnel for innovative and relevant proposals in the target SDRD investment areas; and
3. A review process to select from the proposals a SDRD project portfolio for funding.

*Program Planning.* The SDRD program will use appropriate strategic plans and DP goals to identify strategic technology needs and establish SDRD objectives to address near-term, mid-term and long-term competence for assigned missions.

*Call for Employee-suggested Proposals.* Once the strategic direction is established, a call for proposals will be issued to the NTS scientific and engineering community. This broad-based call for proposals will result in participation of numerous scientists, engineers, and technicians yielding numerous innovative approaches to meeting the strategic SDRD objectives.

*Review and Selection of Proposals for funding.* All proposals are subject to two types of review, a technical review by scientists, engineers, and program management personnel, and an operational management review. The technical review is performed against

criteria that include an evaluation of the proposal's balance of innovation, impact, and risk with programmatic and strategic relevance. The management review includes participation by senior functional and programmatic management to select sound technical proposals that are aligned with the strategic goals and objectives of the NTS mission.

### **Fiscal Guidance**

The maximum funding level established for SDRD must not exceed 2 percent of the NNSA operating budget for the year as determined by Congress. Construction line item projects are excluded. SDRD expenditures shall be considered an allowable cost in accordance with the terms and conditions of the operating contract and shall be identified in the accounting system.

The FY 2001 Energy and Water Development Appropriations Subcommittee Conference Report directed the Chief Financial Officer (CFO) to develop and execute a financial report of SDRD expenditures by project. The CFOs of the Sites are responsible for preparing this report and it will include written assurance that the method for accumulating SDRD funds is consistent with DOE Order 413.2A. In addition, CFOs shall assure that cost information reported by their Site is in agreement with the NTS financial records.

### **Defense Programs Oversight of the SDRD program**

The SDRD oversight activities ensure that NTS carries out the objectives stated in the law enabling the Program. SDRD oversight is managed through the NNSA/NV Site Office in a process that is consistent with the LDRD oversight process. The Site Office reviews the program and process to ensure that it adheres to NNSA policy and guidance, is consistent with DP mission needs, and recommends approval of the SDRD program plan for the upcoming year to the DP Program Manager.

As part of the appraisal of overall contractor performance, NNSA/NV will conduct an annual evaluation of SDRD activities at NTS. This evaluation looks at the quality of the technical work, strategic alignment, and relevance to the NNSA missions. This annual evaluation relies heavily on the NTS self-assessment process. The result of this evaluation is additional input for DP in the assessment of the value and level of funding for the SDRD activities.

Technical program reviews to ensure that the SDRD program and individual projects are in support of the NNSA mission will be conducted in conjunction with LDRD working group meetings. Due to the similarities between the SDRD program and the Plant Directed Research Development and Demonstration (PDRD) program, SDRD Managers will also participate, when feasible, in PDRD working group meetings. The NTS SDRD

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Program Manager will schedule all Principal Investigators to present their work at least once during the life of their project.

Nevada Test Site will submit to NNSA/NV and DP, a proposed SDRD program plan for the upcoming fiscal year. Both the Site Office and the DP Program Manager will review and analyze the plan, taking into account NNSA policy, alignment with guidance, mission relevance, strategic planning, operational needs, and general program performance. In coordination with the DP Program Manager, the Site Office resolves any outstanding issues with the proposed plan and provides a recommendation to the Cognizant Secretarial Officer or designee on the plan and the program funding level. Prior to the beginning of a new fiscal year, the Cognizant Secretarial Officer or designee assesses the information submitted by the sites and issues a memorandum approving the SDRD program plan and the maximum percent of the site's operating budget that may be used to fund the program.

NNSA/NV Site Office concurrence is required prior to initiating work on an SDRD project.

**Fiscal Year 2003 SDRD Program Expenditures**

The following table shows FY 2003 SDRD program expenditures. It should be noted that the table includes all SDRD costs including individual project costs listed in Note 1 and any administrative costs not specifically assigned to individual FY 2003 projects.

Site	NNSA/DP Funding (\$M)	SDRD Costs (\$M)	SDRD Fraction
NTS	\$283	\$4.5	1.59%